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Distribution Routes of Some Aquatic Oligochaeta

T. Timm

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In this article, the process whereby the bodies of water in the Northwest of the USSR became populated by aquatic Oligochaeta during the postglacial period is discussed, together with certain theoretical problems. For this purpose, use has been made of personal observations by the author and of a wide selection of Soviet and foreign literature.

Modes of distribution

(1) Fairly slow; active locomotion in the ground: in the macrobenthos of Lake Võrtsjärv the range of Isochaetides newaensis is expanding by not more than 10m annually.

(2) Swimming (mainly the Naididae), which is much more effective. Stylaria lacustris, for example, is occasionally found in the pelagic zone of the lakes, where it is an irregular inhabitant. In Lake Chudskoe, in the summer of 1959 the zone populated by Nais barbata and Stylaria lacustris was observed to be expanding by approximately 1 km a month.

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*The figures in the right-hand margin are page numbers of the original (Tr.).

(3) The current scatters the worms, whether they be swimming or rolling along the bottom, together with drifting plants, logs, ice, etc. In the rivers they are dispersed very rapidly with the current, and very slowly - against it.

(4) The Oligochaeta are more easily distributed from basin to basin via waterways (narrows, canals, floods from meltwaters, and ground waters). Here, migration between water divides may also be significant.

(5) In the case of forms with dormant stages (cysts of Aeolosoma and overwintering cocoons of Naididae) it is possible that they are dispersed by the wind. Such forms can also live in isolated temporary pools.

(6) Both the cocoons (or cysts) and the worms may be transported by birds or mammals that have become smeared with mud or are carrying aquatic plants. Humid weather facilitates such resettlement.

(7) Also contributing to resettlement of the worms are many types of 26
human activity: shipping, the building of canals and water reservoirs, water pollution (including the thermal type), the keeping of aquaria, freight haulage, etc.

The capacity of the various Oligochaeta for resettlement

The most easily resettled forms are those with dormant stages which reproduce asexually: Aeolosoma and the Naididae. A single individual is all that is necessary for them to establish a new population. In these groups, cosmopolitan species are fairly numerous.

In the remaining groups, a small number of representatives have the asexual method of reproduction, for example Lumbriculus, Aulodrilus, Bothrioneurum and Potamothrix bedoti. They, too, are characterised by extensive ranges.

Of the species with exclusively sexual reproduction the eurybionts can easily be distributed (for example, Tubifex tubifex and Limnodrilus hoffmeisteri). In the case of the worms adapted to life under specific conditions - the rheobionts, the limnobionts (for example, Lamprodrilus isoporus) and especially the inhabitants of groundwaters (many of the Lumbriculidae), range expansion is difficult.

Methods of studying the evolution of ranges

(1) When perennial aggregations are present, direct observations of the distribuiton of Oligochaeta can hardly ever be accomplished. Examples are: the distribution of Potamothrix vejdovskyi in the Volga reservoirs, the occurrence of P. moldaviensis in Lake Võrtsjärv.

(2) A detailed study of ranges, having regard to past and present linkages between bodies of water. An example of this is the history of resettlement of Isochaetides newaensis, discussed below.

(3) Comparison of the ranges of allied species sometimes reveals the centre of speciation of the genus, and consequently, the direction of distribution of species. For example, 12 of the 18 species of Potamothrix and 6 of the 9 European species of Psammoryctides are endemic in South-eastern Europe - from the Balkan Peninsula to the Caspian Sea. It is assumed that the remaining species of these genera, widely distributed today in Europe and beyond its boundaries, have originated from there.

The history of resettlement of the natural bodies of water in the Soviet Northwest

The bodies of water that constitute the basins of the Baltic and White Seas are of fairly recent origin. Eighteen thousand years ago this area

was covered by continental ice. The hydrofauna that had been displaced by the glacier returned there gradually, as the glacier retreated.

A peculiarity of the region was the position of the main water divide to the south and east of the edge of the glacial shield. The rivers flowed towards the glacier, at the edge of which they coalesced with the meltwaters, forming large periglacial lakes. The runoff from these lakes followed the urstromtalen lengthwise along the edge of the glacier. Following the retreating glacier, an intricate network of periglacial lakes crept slowly across the entire area in the course of seven or eight thousand years. In the process, the links between the lakes and the direction of the current in the rivers and urstromtalen repeatedly altered. By the end of the glacial epoch, about 10,000 years ago, the remnants of the periglacial lakes flowed together in the Baltic Lake-Sea, which has remained almost salt-free for 2,000 years. The White Sea, on the other hand, immediately became saline. 27

The vast majority of the eurybiontic and cold-loving species of the contemporary Oligochaeta fauna of the Northwestern USSR undoubtedly inhabited the periglacial lakes throughout the whole of the glacial period, from where they immediately entered the "normal" bodies of water in process of formation. The fauna of the Extreme North indicates that even today, many oligochaetes can live at a constantly low temperature. Consequently, the main nucleus of the oligochaete fauna was already formed by the end of the glacial epoch.

This is indirectly proven by the richness of the fresh-water fauna of the islands of Saaremaa and Hiiumaa, and of the Solovetskie Islands,

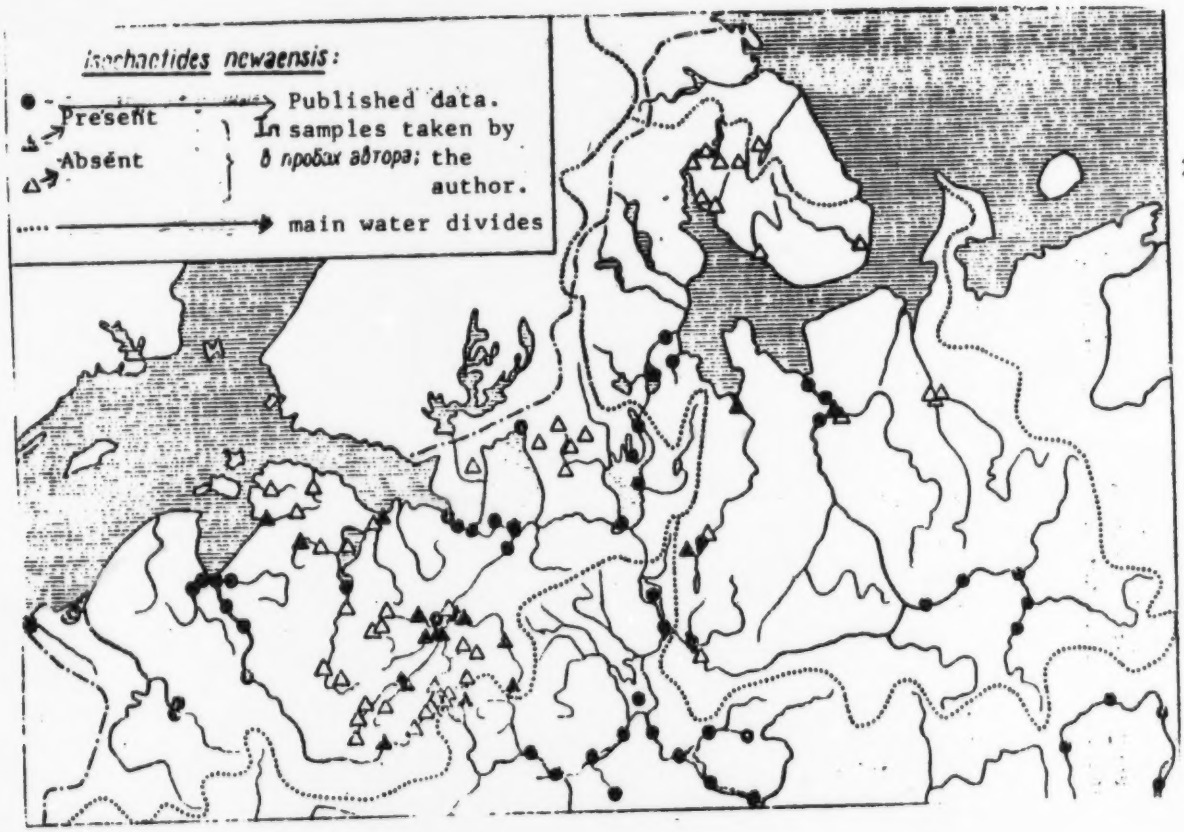
which emerged respectively from the fresh Baltic Lake-Sea and from the periglacial lake of Onega Bay. On the other hand, gaps are observed in the fauna of Kola Peninsula, which had become insulated from the Eastern European network of periglacial lakes by the saline White Sea: Lamprodrilus species are absent, Potamothrix hammoniensis is localised in the south-western part, etc.

On Saaremaa Island there are rivers in which Limnodrilus hoffmeisteri is absent, but the rarer L. claparedeanus is flourishing. Apparently, Limnodrilus species were not abundant in the oligotrophic Baltic Lake-Sea and their entry into the rivers was dependent on chance.

Only Rhyacodrilus coccineus entered the Estonian bodies of water from the Lake-Sea. This species is abundant in the rivers and creeks emptying directly into the sea, but is absent in the rivers of the Lake Chudskoe system (with a waterfall at the outlet). It is true that it inhabits Lake Chudskoe itself and Lake Võrtsjärv which is connected with the latter, to where it was evidently brought relatively recently (by man?) and has still not succeeded in penetrating the tributaries.

The evolution of the oligochaete fauna was stabilised in the Holocene. As climatic warming, eutrophication and dystrophication proceeded, the ranges of some of the more demanding species, especially the Lumbriculidae, even contracted and became relict (for example, that of Tatriella slovenica).

Rapid enrichment of the fauna began during the last century. Under human influence, many oligochaetes of the estuary complex of the Ponto-Caspian Basin, frequently behaving as rheophiles in the North, have started to spread vigorously into the water bodies.


Isochactides newaensis:
Present
Absent
Published data.
In samples taken by
В пробах автора; the
author.
main water divides

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The most populous of these species is Isochaetides newaensis, the ancient home of which may be the Volga and whose unbroken range encompasses the rivers emptying into the Ponto-Caspian seas from the north. In the Danube it is apparently a fairly recent arrival. On consulting the illustration on page 6 it will be seen that this species could not have gained entry to the basin of the Baltic Sea prior to the 18th century. It 29
in particular occurs all the way to the headwaters of the Msta River, which forms part of the Vyshnevolotskoe canal system, connecting the tributaries of the Volga with those of the Volkhov and which was partially contructed in the 18th century and is now abandoned. In the upper reaches of the Western Dvina, the Lovat' and the Pola - in the areas of the more ancient, negotiable waterways the species is absent. A second, more recent I. newaensis settlement of the rivers forming the basin of the Baltic Sea by way of the Oginskii and Mariinskii canals and via the present Volga-Baltic system is certainly fully possible. I. newaensis had already been carried to the mouths of the Western Dvina, Lielupe, Gauya, Pyarnu and Narva rivers by ships in transit from the Neva or Neman by way of the Baltic Sea. It spread to the north of Karelia by way of the White Sea-Baltic Canal and to the Northern Dvina, it would seem, by transiting Lake Kubenskoe.

Besides I. newaensis, also to be numbered among the recent settlers of the estuary complex are I. michaelseni, Psammoryctides moravicus, Potamothrix moldaviensis, P. bavaricus, P. heuscheri, P. vejdovskyi and Paranais frici, some of which could also have penetrated the basin of the Baltic Sea by way of Central Europe. Their ranges do not coincide: for example, in Estonia P. moldaviensis is more widely distributed than I. newaensis, while in Karelia the opposite is the case.

The latest wave of settlers in Europe are anthropochorial heat-loving species from tropical countries (Branchiura sowerbyi, some species of Aeolosoma and perhaps also of Aulophorus furcatus), which inhabit botanical gardens and the cooled waters of electric power stations. In the Northwest of the USSR the oligochaete fauna of such habitats has scarcely been studied at all.

ON THE DISTRIBUTION WAYS OF SOME AQUATIC *OLIGOCHAETA*

T. TIMM

Summary

Various active and passive distribution mechanisms of various oligochaete groups are discussed, as well as the possible methods for studying their distribution range. An attempt is made to outline the changes of distribution ranges accompanied by an evolution of natural conditions on a concrete territory — the northwestern part of the Soviet Union. Periglacial lakes represent the original habitat of the local freshwater oligochaete fauna, while a lot of species, mostly of Ponto-Caspian origin, have recently proceeded to local waters via navigable canals.